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(54) **ARC DEPOSITION SYSTEM**

LICHTBOGENABSCHEIDUNGSSYSTEM

SYSTÈME DE DÉPÔT PAR ARC

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EP 4 199 036 B1

Description

TECHNICAL FIELD

[0001] The invention relates to an arc deposition system. In embodiments, the invention relates to a multi racetrack cathodic arc. In at least one aspect, a cathodic arc coating system using cathodic arc sources with multiple racetracks that can be simultaneously generated is provided.

BACKGROUND

[0002] US2010/213054 A1 discloses a vacuum coating apparatus. The apparatus includes a cathode target, a plurality of anodes, a transiting device, a pulsed arc discharge device, and a pulsed laser device. The plurality of anodes is placed on the transiting device and successively passes through a working position by the transiting device. The pulsed arc discharge device is electrically connected to the cathode target and the anode at the operable position to form plasma in a vacuum chamber for film coating. The pulsed laser device is located outside of the vacuum chamber and provides a pulsed laser beam onto the surface of the cathode surface to serve as a plasma trigger. A coating method for the vacuum coating apparatus is also disclosed.

[0003] EP2866246 A1 discloses a vacuum coating and plasma treatment system including a magnetron cathode with a long edge and a short edge. The magnetic pole of the magnetron results in an electromagnetic barrier. At least one remote arc discharge is generated separate from the magnetron cathode and in close proximity to the cathode so that it is confined within a volume adjacent to the magnetron target. The remote arc discharge extends parallel to the long edge of the magnetron target and is defined by the surface of the target on one side and the electromagnetic barrier on all other sides.

[0004] US2020240002 A1 discloses an arrangement for coating substrate surfaces by means of electric arc discharge in a vacuum chamber, wherein electric arc discharges are used between a target, which is electrically connected as a cathode and is formed from a metal material and an anode. Arranged at a distance from the target is an anode, with which the electric arc discharges are ignited to form a plasma formed with metal material of the target.

[0005] EP0492592 A1 disclose a vacuum arc deposition device comprising a vacuum vessel, a vacuum arc evaporation source disposed in the vacuum vessel, a plurality of arc current introduction portions disposed to the vacuum arc evaporation source, and a plurality of arc discharge power sources for supplying arc electric power correspondingly to the plurality of arc current introduction portions

[0006] WO2013/083495 A1 discloses a filtered cathodic vacuum arc source for thin film deposition, using a rotary arc cathode substantially having cylindrical shape containing film forming material. Said rotary arc cathode is consumable on its outer cylinder jacket. The arc source comprises a focusing magnetic field source placed between the arc cathode and the substrate holder, wherein an arc spot is generated on the target surface and kept by the magnetic field lines in the place where the magnetic field lines are perpendicular to the target surface. The magnetic field lines are constricted in the space between the rotary arc cathode and the substrate holder by a baffle.

[0007] Increasing deposition rates in arc deposition will also be desirable. Currently, there are magnetically confined cathodic arc sources available with exactly one active racetrack. Currently, increasing the number of racetracks to increase deposition is not available.

[0008] Accordingly, there is a need for improved arc deposition systems that utilize multiple racetracks in a more effective manner.

SUMMARY

[0009] In at least one aspect, an arc deposition system is provided. The arc deposition system includes a coating chamber and a central cathode target disposed within the coating chamber. At least two anodes surround the central cathode target. Each anode is positively biased with respect to the central cathode target such that each anode independently induces an associated racetrack erosion profile on the central cathode target. At least two magnetic components are positioned within the central cathode target. The at least two magnetic components guide an associated arc that forms the associated racetrack erosion profile. Characteristically, each anode of the at least two anodes has an associated magnetic component.

[0010] In another aspect, an arc deposition system that includes two anodes is provided. The arc deposition system includes a coating chamber, a central cathode target disposed within the coating chamber, a first anode, and a second anode. Characteristically, the first anode and the second anode surround the central cathode target. The first anode is positively biased with respect to the central cathode target such that the first anode induces a first racetrack erosion profile on the central cathode target. Similarly, the second anode is positively biased with respect to the central cathode target such that the second anode induces a second racetrack erosion profile on the central cathode target. A first magnetic component for guiding a first arc forms the first racetrack erosion profile and a second magnetic component for guiding a second arc forms the second racetrack erosion profile. Characteristically, the first magnetic component and the second magnetic component are located within the central cathode target.

[0011] In another aspect, the problems of the prior art with respect to multiple racetrack erosion profiles is solved by the separation of the current paths between racetracks.

[0012] In another aspect, two current sources are attached to a singular cathodic target. Instead of using the chamber wall as an anode, two separate anodes are attached facing their respective racetrack erosion profiles. This geometric difference is what makes each current path prefer their respective racetrack erosion profiles. This concept can be expanded to any number of racetrack erosion profiles.

[0013] According to a first aspect of the present invention, there is provided an arc deposition system, as defined in claim 1, comprising: a coating chamber; a central cathode target disposed within the coating chamber; at least two anodes surrounding the central cathode target, each anode being positively biased with respect to the central cathode target such that each anode independently induces an associated racetrack erosion profile on the central cathode target; and at least two magnetic components located within the central cathode target for guiding an associated arc that forms its associated racetrack erosion profile, each anode of the at least two anodes having an associated magnetic component.

[0014] In an embodiment, at least two anodes are equally spaced around the central cathode target.

[0015] In an embodiment, the central cathode target rotates about a longitudinal axis of the central cathode target.

[0016] In an embodiment, at least two anodes include only two anodes.

[0017] In an embodiment, the arc deposition system further comprises a controller that controls controllable components of the arc deposition system.

[0018] In an embodiment, the arc deposition system further comprises a power supply system for biasing each of the at least two anodes with respect to the central cathode target.

[0019] In an embodiment, the power supply system includes a power supply subsystem to positively bias each anode of the at least two anodes with respect to the central cathode target.

[0020] In an embodiment, each anode of the at least two anodes is positively biased with respect to the central cathode target.

[0021] In an embodiment, each anode of the at least two anodes is positively biased with respect to the central cathode target with a DC voltage between -15 and -50 V.

[0022] In an embodiment, a current from 100 to 600 A flows through each anode.

[0023] In an embodiment, the controller is configured to simultaneously activate each anode.

[0024] In an embodiment, the controller is configured to activate the at least two anodes in an alternating manner.

[0025] In an embodiment, the arc deposition system further comprises a striker for each anode to initiate an arc.

[0026] In an embodiment, the coating chamber is at an operating pressure between 0.5 and 50 mTorr.

[0027] According to a second aspect of the present invention, there is provided an arc deposition system comprising: a coating chamber; a central cathode target disposed within the coating chamber; a first anode; a second anode, the first anode and the second anode surrounding the central cathode target, the first anode being positively biased with respect to the central cathode target such that the first anode induces a first racetrack erosion profile on the central cathode target, the second anode being positively biased with respect to the central cathode target such that the second anode induces a second racetrack erosion profile on the central cathode target;

[0028] a first magnetic component for guiding a first arc that forms the first racetrack erosion profile; and a second magnetic component for guiding a second arc that forms the second racetrack erosion profile, wherein the first magnetic component and the second magnetic component are located within the central cathode target.

[0029] In an embodiment, the first anode and the second anode are equally spaced around the central cathode target.

[0030] In an embodiment, the arc deposition system further comprises a controller that controls controllable components of the arc deposition system.

[0031] In an embodiment, the arc deposition system further comprises a power supply system for biasing each of first anode and the second anode with respect to the central cathode target.

[0032] In an embodiment, the power supply system includes a power supply subsystem to positively bias each anode of the first anode and the second anode with respect to the central cathode target.

[0033] In an embodiment, the controller is configured to simultaneously activate each anode.

[0034] In an embodiment, the controller is configured to activate the first anode and the second anode in an alternating manner.

[0035] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] For a further understanding of the nature, objects, and advantages of the present disclosure, reference should be had to the following detailed description, read in conjunction with the following drawings, wherein like reference numerals denote like elements and wherein:

FIGURE 1A. Schematic of a cathodic arc deposition system having arc spots forming two racetrack erosion profiles.

FIGURE 1B. Top view of a magnetic component for guiding arcs to form associated racetrack erosion

profiles.

DETAILED DESCRIPTION

[0037] Reference will now be made in detail to presently preferred embodiments and methods of the present invention, which constitute the best modes of practicing the invention presently known to the inventors. The Figures are not necessarily to scale. However, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be embodied in various and alternative forms. Therefore, specific details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for any aspect of the invention and/or as a representative basis for teaching one skilled in the art to variously employ the present invention.

[0038] It is also to be understood that this invention is not limited to the specific embodiments and methods described below, as specific components and/or conditions may, of course, vary. Furthermore, the terminology used herein is used only for the purpose of describing particular embodiments of the present invention and is not intended to be limiting in any way.

[0039] It must also be noted that, as used in the specification and the appended claims, the singular form "a," "an," and "the" comprise plural referents unless the context clearly indicates otherwise. For example, reference to a component in the singular is intended to comprise a plurality of components.

[0040] The term "comprising" is synonymous with "including," "having," "containing," or "characterized by." These terms are inclusive and open-ended and do not exclude additional, unrecited elements or method steps.

[0041] The phrase "consisting of" excludes any element, step, or ingredient not specified in the claim. When this phrase appears in a clause of the body of a claim, rather than immediately following the preamble, it limits only the element set forth in that clause; other elements are not excluded from the claim as a whole.

[0042] The phrase "consisting essentially of" limits the scope of a claim to the specified materials or steps, plus those that do not materially affect the basic and novel characteristic(s) of the claimed subject matter.

[0043] With respect to the terms "comprising," "consisting of," and "consisting essentially of," where one of these three terms is used herein, the presently disclosed and claimed subject matter can include the use of either of the other two terms.

[0044] It should also be appreciated that integer ranges explicitly include all intervening integers. For example, the integer range 1-10 explicitly includes 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. Similarly, the range 1 to 100 includes 1, 2, 3, 4.... 97, 98, 99, 100. Similarly, when any range is called for, intervening numbers that are increments of the difference between the upper limit and the lower limit divided by 10 can be taken as alternative upper or lower limits. For example, if the range is 1.1. to 2.1 the following numbers 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, and 2.0 can be selected as lower or upper limits.

[0045] When referring to a numerical quantity, in a refinement, the term "less than" includes a lower non-included limit that is 5 percent of the number indicated after "less than." A lower non-includes limit means that the numerical quantity being described is greater than the value indicated as a lower non-included limited. For example, "less than 20" includes a lower non-included limit of 1 in a refinement. Therefore, this refinement of "less than 20" includes a range between 1 and 20. In another refinement, the term "less than" includes a lower non-included limit that is, in increasing order of preference, 20 percent, 10 percent, 5 percent, 1 percent, or 0 percent of the number indicated after "less than."

[0046] With respect to electrical devices, the term "connected to" means that the electrical components referred to as connected to are in electrical communication. In a refinement, "connected to" means that the electrical components referred to as connected to are directly wired to each other. In another refinement, "connected to" means that the electrical components communicate wirelessly or by a combination of wired and wirelessly connected components. In another refinement, "connected to" means that one or more additional electrical components are interposed between the electrical components referred to as connected to with an electrical signal from an originating component being processed (e.g., filtered, amplified, modulated, rectified, attenuated, summed, subtracted, etc.) before being received to the component connected thereto.

[0047] The term "electrical communication" means that an electrical signal is either directly or indirectly sent from an originating electronic device to a receiving electrical device. Indirect electrical communication can involve processing of the electrical signal, including but not limited to, filtering of the signal, amplification of the signal, rectification of the signal, modulation of the signal, attenuation of the signal, adding of the signal with another signal, subtracting the signal from another signal, subtracting another signal from the signal, and the like. Electrical communication can be accomplished with wired components, wirelessly connected components, or a combination thereof.

[0048] The term "one or more" means "at least one" and the term "at least one" means "one or more." The terms "one or more" and "at least one" include "plurality" as a subset.

[0049] The term "substantially," "generally," or "about" may be used herein to describe disclosed or claimed embodiments. The term "substantially" may modify a value or relative characteristic disclosed or claimed in the present disclosure. In such instances, "substantially" may signify that the value or relative characteristic it modifies is within ± 0%, 0.1%, 0.5%, 1%, 2%, 3%, 4%, 5% or 10% of the value or relative characteristic.

[0050] The term "electrical signal" refers to the electrical output from an electronic device or the electrical input

to an electronic device. The electrical signal is characterized by voltage and/or current. The electrical signal can be stationary with respect to time (e.g., a DC signal) or it can vary with respect to time.

[0051] The terms "DC signal" refer to electrical signals that do not materially vary with time over a predefined time interval. In this regard, the signal is DC over the predefined interval. "DC signal" includes DC outputs from electrical devices and DC inputs to devices.

[0052] The term "electronic component" refers to any physical entity in an electronic device or system used to affect electron states, electron flow, or the electric fields associated with the electrons. Examples of electronic components include, but are not limited to, capacitors, inductors, resistors, thyristors, diodes, transistors, etc. Electronic components can be passive or active.

[0053] The term "electronic device" or "system" refers to a physical entity formed from one or more electronic components to perform a predetermined function on an electrical signal.

[0054] It should be appreciated that in any figures for electronic devices, a series of electronic components connected by lines (e.g., wires) indicates that such electronic components are in electrical communication with each other. Moreover, when lines directed connect one electronic component to another, these electronic components can be connected to each other as defined above.

[0055] The term "electrical communication" means that an electrical signal is either directly or indirectly sent from an originating electronic device to a receiving electrical device. Indirect electrical communication can involve processing of the electrical signal, including but not limited to, filtering of the signal, amplification of the signal, rectification of the signal, modulation of the signal, attenuation of the signal, adding of the signal with another signal, subtracting the signal from another signal, subtracting another signal from the signal, and the like. Electrical communication can be accomplished with wired components, wirelessly connected components, or a combination thereof.

[0056] With reference to Figure 1A, a schematic of a cathode arc deposition system is provided. Arc deposition system 10 includes a coating chamber 12. In a refinement, arc deposition system 10 is a cathode arc deposition system. Central cathode target 14 is disposed in the coating chamber 10 and surrounded by at least two anodes 16^i, where i is an integer label running from 1 to the total number of anodes which is at least 2. In a refinement, the at least two anodes 16' includes only include 2, 3, 4, or 5 or more anodes. It should be appreciated that the at least two anodes 16^i are used as anodes instead of the chamber wall. For example, a system with two anodes includes anodes 16^1 and 16^2. Central cathode target 14 can be located at the center of coating chamber 12. In a refinement, central cathode target 14 rotates about longitudinal axis a^c running along the long direction of central cathode target 14. In a refinement, the anodes rotate in the opposite direction than the central cathode target. Typically, anodes are equally spaced around the central cathode target. For example, when there are two anodes, each anode will be separated by an angle of about 180 with respect to longitudinal axis a^c.

[0057] Advantageously, each anode is positively biased with respect to the central cathode target 14 such that each anode independently induces an associated racetrack erosion profiles 18' (e.g., profiles 18^1 and 18^2 for two anodes) on the central cathode target. In this regard, arcs 20' (e.g., arcs 20^1 and 20^2 for two anodes) associated with each racetrack erosion profile moves up and down along directions d^1 and d^2, respectively. In a refinement, directions d^i (e.g., d^1 and d^2 for two anodes) are parallel to the longitudinal axes (e.g., a^1, a^2 for two anodes) through anodes 16' (e.g., anodes 16^1 and 16^2 for two anodes).

[0058] Referring to Figure 1B, magnetic components 24' (e.g., magnetic components 24^1 and 24^2 for two anodes) are located within central cathode target 14. Magnetic components 24' can be mounted on support 26. In a refinement, central cathode target 14 is rotatable with respect to magnetic components 24'. Typically, arcs are moved along directions d^i with magnetic components 24'. The erosion pattern caused by the motion of these arcs over the surface of central cathode target 14 is referred to as "racetrack erosion profiles." The substrates 22 to be coated are positioned in coating chamber 12 at locations that do not interfere with arcs 20' (e.g., arcs 20^1 and 20^2 for two anodes) associated with each racetrack erosion profile. In a refinement, each of the magnetic components 24' includes bars of permanent magnets arranged along the long central axis of central cathode target 14. In a refinement, the magnetic field strength of magnetic components 24' is from about 10 to 200 Gauss. Figure 1B depicts an example with three magnetic bars with a central magnetic bar arranged in the opposite sense with respect to the magnetic poles (e.g., north-south) to the two outer magnetic bars.

[0059] In a variation, arc deposition system 10 includes a controller 30 that controls the various controllable components described below. Typically, controller 30 includes a central processing unit 32 in electrical communication with computer memory 34 and peripheral interface 36 for connecting computer components such as a mouse, keyboard, monitor, external memory, and the like. In a refinement, controller 30 can also include one or more interface cards or devices for sending electrical signals to the controllable components. In one variation, controller 30 is configured to simultaneously activate each anode. In another variation, controller 30 is configured to activate the at least two anodes in an alternating manner.

[0060] Characteristically, coating chamber 12 is a vacuum coating chamber. Coating chamber 12 is maintained at reduced pressure during coating of a substrate via suitable vacuum system in fluid communication with coating chamber 12 via port 42. Typically, operating pres-

sures are between 0.5 and 50 mTorr. It should be noted that fully reacted coatings can be realized above approximately 1 mTorr. In a refinement, the vacuum system can be controlled by controller 30.

[0061] Arc deposition system 10 can include a power supply system 40 for biasing each of the at least two anodes 16' with respect to the central cathode target 12. In a refinement, the power supply system 40 includes power supply subsystems 42' (e.g., subsystems 42^1 and 42^2 for two anodes) to positively bias each anode of the at least two anodes with respect to the central cathode target. In a refinement, each of the at least two anodes 16' is positively biased with respect to the central cathode target 12 with a DC voltage between -15 and -50 V. The power supply system 40 can also be viewed as providing multiple current sources (one for each anode) that are attached to a singular cathodic target 14. In a further refinement, a current from 100 to 600 A flows through each anode. In a refinement, controller 30 can vary the current input on each anode while maintaining the total arc current substantially constant. In a refinement, controller 20 can send control signals to switches 44^i, with each anode 16' having an associated switch for selecting which anode and the associated racetrack is to be activated. In this regard, controller 30 will send power control signals to switches 44' (e.g., switches 44^1 and 44^2 for two anodes) to make the selection. Arc deposition system 10 can be operated with all the anodes simultaneously activated or with the anodes activated in an alternating manner For the case where there are anodes 16^1 and 16^2, both anodes can be simultaneously activated. Alternatively, activation can alternate between anode 16^1 and anode 16^2. Typically, a striker 50' (e.g., strikers 50^1 and 50^2 for two anodes) is associated with each anode 16'.

[0062] While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms of the invention. The invention is as defined in the claims. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the scope of the invention as defined by the claims. Additionally, the features of various implementing embodiments may be combined to form further embodiments of the invention.

Claims

1. An arc deposition system (10) comprising:

a coating chamber (12);
a central cathode target (14) disposed within the coating chamber;
at least two anodes (16) surrounding the central cathode target (14), wherein each anode is configured to be positively biased with respect to the central cathode target such that each anode independently induces an associated racetrack erosion profile on the central cathode target (14); and
at least two magnetic components (24) located within the central cathode target (14) for guiding an associated arc that forms its associated racetrack erosion profile, each anode of the at least two anodes having an associated magnetic component.

2. The arc deposition system of claim 1, wherein the at least two anodes (16) are equally spaced around the central cathode target (14).

3. The arc deposition system of claim 1 or 2, wherein the central cathode target (14) is configured to rotate about a longitudinal axis of the central cathode target (14).

4. The arc deposition system of any of claims 1 to 3, wherein at least two anodes include only two anodes.

5. The arc deposition system of any of claims 1 to 4, further comprising a controller (30) arranged to control controllable components of the arc deposition system.

6. The arc deposition system of any of claims 1 to 5, further comprising a power supply system (40) arranged to bias each of the at least two anodes with respect to the central cathode target (14).

7. The arc deposition system of claim 6, wherein the power supply system (40) includes a power supply subsystem arranged to positively bias each anode of the at least two anodes with respect to the central cathode target.

8. The arc deposition system of claim 7, wherein each anode of the at least two anodes is configured to be positively biased with respect to the central cathode target (14).

9. The arc deposition system of claim 8, wherein each anode of the at least two anodes is configured to be positively biased with respect to the central cathode target with a DC voltage between -15 and -50 V.

10. The arc deposition system of claim 9, wherein, in use, a current from 100 to 600 A flows through each anode.

11. The arc deposition system of any of claim 5, wherein the controller (30) is configured to simultaneously activate each anode.

12. The arc deposition system of any of claim 5, wherein the controller (30) is configured to activate the at least two anodes in an alternating manner.

13. The arc deposition system of any of claims 1 to 12, further comprising a striker (50) associated with each anode and arranged such that each anode can initiate an arc.

14. The arc deposition system of any of claims 1 to 13, wherein, in use, the coating chamber (12) is at an operating pressure between 0.5 and 50 mTorr.

15. An arc deposition system according to any of claims 1 to 14, wherein the at least two anodes comprise a first anode and a second anode, the first anode and the second anode surrounding the central cathode target, wherein the first anode is configured to be positively biased with respect to the central cathode target such that the first anode induces a first racetrack erosion profile on the central cathode target, and wherein the second anode is configured to be positively biased with respect to the central cathode target (14) such that the second anode induces a second racetrack erosion profile on the central cathode target.

Patentansprüche

1. Lichtbogenabscheidungssystem (10), umfassend:

eine Beschichtungskammer (12);
ein zentrales Kathodenziel (14), das innerhalb der Beschichtungskammer angeordnet ist;
mindestens zwei Anoden (16), die das zentrale Kathodenziel (14) umgeben, wobei jede Anode so konfiguriert ist, dass sie in Bezug auf das zentrale Kathodenziel positiv vorgespannt ist, so dass jede Anode unabhängig ein zugehöriges Racetrack-Erosionsprofil auf dem zentralen Kathodenziel (14) induziert; und
mindestens zwei magnetische Komponenten (24), die innerhalb des zentralen Kathodenziels (14) angeordnet sind, um einen zugehörigen Lichtbogen zu führen, der sein zugehöriges Rennstrecken-Erosionsprofil bildet, wobei jede Anode der mindestens zwei Anoden eine zugehörige magnetische Komponente aufweist.

2. Lichtbogenabscheidungssystem nach Anspruch 1, wobei die mindestens zwei Anoden (16) gleichmäßig um das zentrale Kathodenziel (14) herum angeordnet sind.

3. Lichtbogenabscheidungssystem nach Anspruch 1 oder 2, wobei das zentrale Kathodenziel (14) so konfiguriert ist, dass es sich um eine Längsachse des zentralen Kathodenziels (14) dreht.

4. Lichtbogenabscheidungssystem nach einem der Ansprüche 1 bis 3, wobei mindestens zwei Anoden nur zwei Anoden einschließen.

5. Lichtbogenabscheidungssystem nach einem der Ansprüche 1 bis 4, ferner umfassend eine Steuerung (30), die dazu dient, steuerbare Komponenten des Lichtbogenabscheidungssystems zu steuern.

6. Lichtbogenabscheidungssystem nach einem der Ansprüche 1 bis 5, ferner umfassend ein Stromversorgungssystem (40), das dazu angeordnet ist, jede der mindestens zwei Anoden in Bezug auf das zentrale Kathodenziel (14) vorzuspannen.

7. Lichtbogenabscheidungssystem nach Anspruch 6, wobei das Stromversorgungssystem (40) ein Stromversorgungssubsystem einschließt, das dazu angeordnet ist, jede Anode der mindestens zwei Anoden in Bezug auf das zentrale Kathodenziel positiv vorzuspannen.

8. Lichtbogenabscheidungssystem nach Anspruch 7, wobei jede Anode der mindestens zwei Anoden so konfiguriert ist, dass sie in Bezug auf das zentrale Kathodenziel (14) positiv vorgespannt ist.

9. Lichtbogenabscheidungssystem nach Anspruch 8, wobei jede Anode der mindestens zwei Anoden so konfiguriert ist, dass sie in Bezug auf das zentrale Kathodenziel mit einer Gleichspannung zwischen -15 und -50 V positiv vorgespannt ist.

10. Lichtbogenabscheidungssystem nach Anspruch 9, wobei im Betrieb ein Strom von 100 bis 600 A durch jede Anode fließt.

11. Lichtbogenabscheidungssystem nach Anspruch 5, wobei die Steuerung (30) so konfiguriert ist, dass sie jede Anode gleichzeitig aktiviert.

12. Lichtbogenabscheidungssystem nach Anspruch 5, wobei die Steuerung (30) so konfiguriert ist, dass sie die mindestens zwei Anoden abwechselnd aktiviert.

13. Lichtbogenabscheidungssystem nach einem der Ansprüche 1 bis 12, ferner umfassend einen Zünder (50), der mit jeder Anode verbunden und so angeordnet ist, dass jede Anode einen Lichtbogen auslösen kann.

14. Lichtbogenabscheidungssystem nach einem der Ansprüche 1 bis 13, wobei im Betrieb in der Beschichtungskammer (12) ein Betriebsdruck zwischen 0,5 und 50 mTorr herrscht.

15. Lichtbogenabscheidungssystem nach einem der Ansprüche 1 bis 14, wobei die mindestens zwei Anoden eine erste Anode und eine zweite Anode umfassen, wobei die erste Anode und die zweite Anode

das zentrale Kathodenziel umgeben, wobei die erste Anode so konfiguriert ist, dass sie in Bezug auf das zentrale Kathodenziel positiv vorgespannt ist, so dass die erste Anode ein erstes Rennbahn-Erosionsprofil auf dem zentralen Kathodenziel induziert, und wobei die zweite Anode so konfiguriert ist, dass sie in Bezug auf das zentrale Kathodenziel (14) positiv vorgespannt ist, so dass die zweite Anode ein zweites Rennbahn-Erosionsprofil auf dem zentralen Kathodenziel induziert.

Revendications

1. Système de dépôt par arc (10), comprenant :

une chambre de revêtement (12) ;
une cible de cathode centrale (14) disposée dans la chambre de revêtement ;
au moins deux anodes (16) entourant la cible de cathode centrale (14),
dans lequel chaque anode est configurée pour être positivement polarisée par rapport à la cible de cathode centrale de telle sorte que chaque anode induit indépendamment un profil d'érosion de piste de course associé sur la cible de cathode centrale (14) ; et
au moins deux composants magnétiques (24) situés dans la cible de cathode centrale (14) pour guider un arc associé qui forme son profil d'érosion de piste de course associé, chaque anode des au moins deux anodes ayant un composant magnétique associé.

2. Système de dépôt par arc selon la revendication 1, dans lequel les au moins deux anodes (16) sont également espacées autour de la cible de cathode centrale (14).

3. Système de dépôt par arc selon la revendication 1 ou 2, dans lequel la cible de cathode centrale (14) est configurée pour tourner autour d'un axe longitudinal de la cible cathodique centrale (14).

4. Système de dépôt par arc selon l'une quelconque des revendications 1 à 3, dans lequel au moins deux anodes comportent seulement deux anodes.

5. Système de dépôt par arc selon l'une quelconque des revendications 1 à 4 comprenant en outre un dispositif de commande (30) conçu pour commander les composants pouvant être commandés du système de dépôt par arc.

6. Système de dépôt par arc selon l'une quelconque des revendications 1 à 5 comprenant en outre un système d'alimentation électrique (40) conçu pour polariser chacune des au moins deux anodes par rapport à la cible de cathode centrale (14).

7. Système de dépôt par arc selon la revendication 6, dans lequel le système d'alimentation électrique (40) comporte un sous-système d'alimentation électrique conçu pour polariser positivement chaque anode des au moins deux anodes par rapport à la cible cathodique centrale.

8. Système de dépôt par arc selon la revendication 7, dans lequel chaque anode des au moins deux anodes est configurée pour être positivement polarisée par rapport à la cible cathodique centrale (14).

9. Système de dépôt par arc selon la revendication 8, dans lequel chaque anode des au moins deux anodes est configurée pour être polarisée positivement par rapport à la cible cathodique centrale avec une tension continue comprise entre -15 et -50 V.

10. Système de dépôt par arc selon la revendication 9, dans lequel, lors de l'utilisation, un courant de 100 à 600 A traverse chaque anode.

11. Système de dépôt par arc selon l'une quelconque revendication 5, dans lequel le dispositif de commande (30) est configuré pour activer simultanément chaque anode.

12. Système de dépôt par arc selon l'une quelconque revendication 5, dans lequel le dispositif de commande (30) est configuré pour activer les au moins deux anodes de manière alternée.

13. Système de dépôt par arc selon l'une quelconque des revendications 1 à 12, comprenant en outre un percuteur (50) associé à chaque anode et conçu de telle sorte que chaque anode peut amorcer un arc.

14. Système de dépôt par arc selon l'une quelconque des revendications 1 à 13, dans lequel, lors de l'utilisation, la chambre de revêtement (12) est à une pression de fonctionnement comprise entre 0,5 et 50 mTorr.

15. Système de dépôt par arc selon l'une quelconque des revendications 1 à 14, dans lequel les au moins deux anodes comprennent
une première anode et une seconde anode, la première anode et la seconde anode entourant la cible de cathode centrale, dans lequel la première anode est configurée pour être polarisée positivement par rapport à la cible de cathode centrale de telle sorte que la première anode induit un premier profil d'érosion de piste de course sur la cible de cathode centrale, et dans lequel la seconde anode est configurée pour être polarisée positivement par rapport à la cible de cathode centrale (14) de telle sorte que la secon-

de anode induit un second profil d'érosion de piste de course sur la cible de cathode centrale.

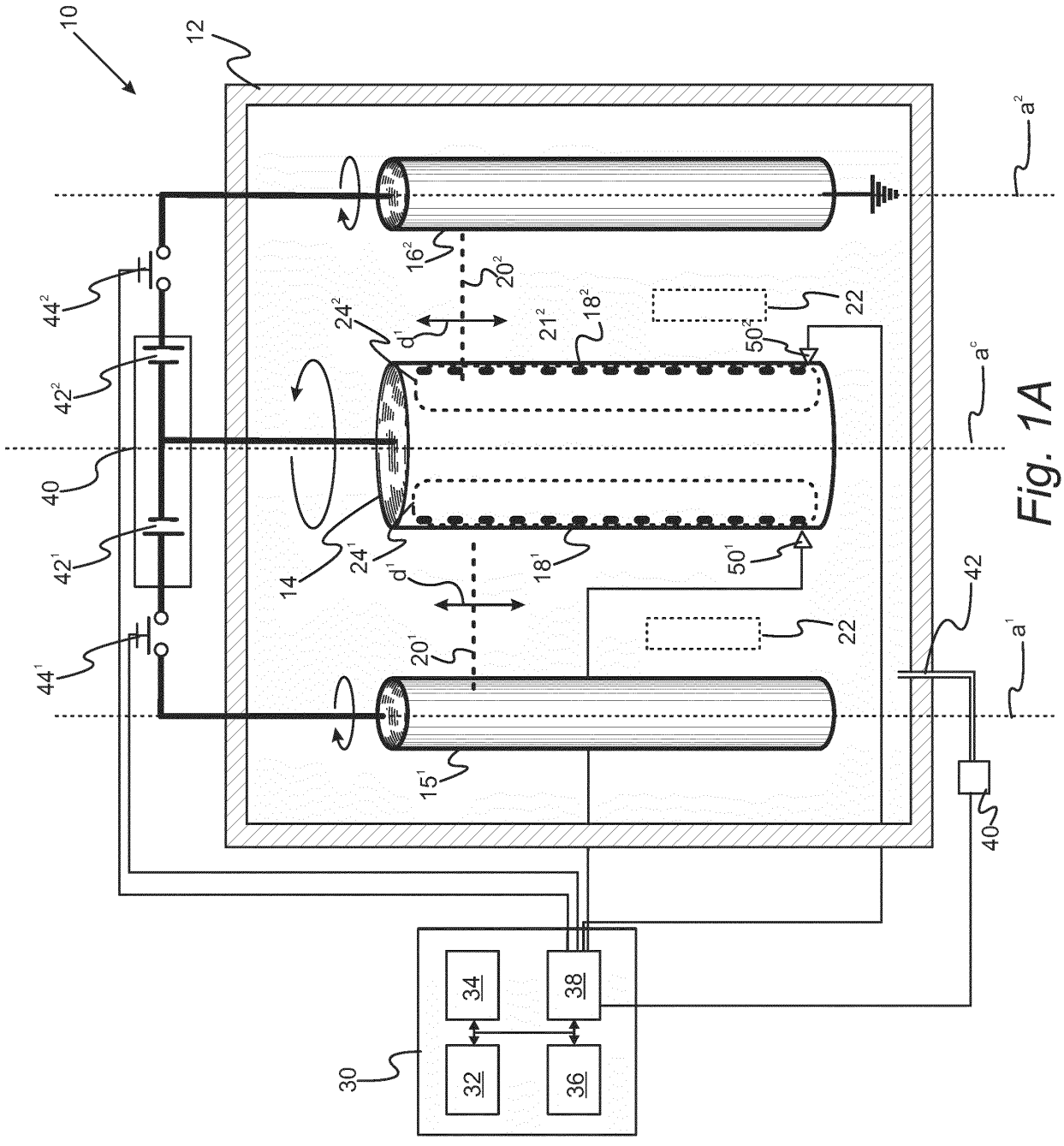

10
12
a²
16²
20²
24²
d¹
21²
18²
22
50²
44²
42²
40
a^c
42¹
14
24¹
d¹
18¹
50¹
22
42
20¹
44¹
a¹
15¹
40
34
38
32
36
30

Fig. 1A

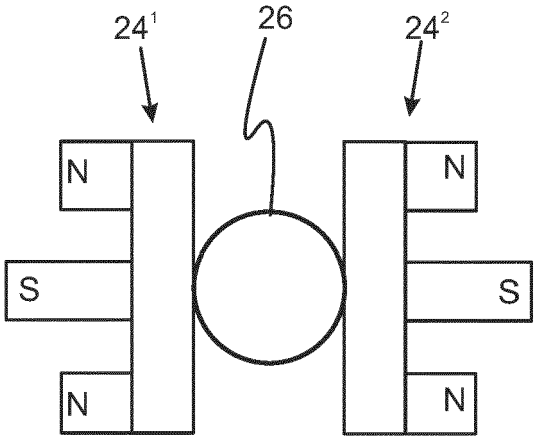


Fig. 1B

REFERENCES CITED IN THE DESCRIPTION

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